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Development of Mobile Photovoltaic Robot for Exploring Disaster Area

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ABSTRACT

A mobile robot for exploring disaster area in tropical region has been developed. It has capability to travel over a rough irregular terrain within disaster area and capable of performing a range of functions such as collecting samples and capturing images from the disaster scene. Furthermore, the robot is equipped with solar panel for extending the operation rather than relying on rechargeable battery only. Construction of the robot consists of 2 degrees of freedom (DOF) in robot arm, including gripper, wireless camera, wireless RF controller and electrical controller of photovoltaic system. The robot can be controlled remotely and also has capability to send captured images wirelessly to a designated controller/server. The transmitted live images can also be used to monitor robot movement and allow real time interactions between the operator and the robot.

1. INTRODUCTION

Today natural disasters occurring frequently across the globe cause severe devastation of the existing infrastructure in addition to huge fatalities [1]. When a major disaster occurred and devastating public infrastructure such as buildings, elevated highways and roads, this creates a situation where the rescue teams and other ground-based operations may be prevented from reaching the disaster area that further increase unnecessary fatalities. Rescue operation in many instances are limited to very slow pace or are even halted from progressing due to both the risk of injury/damage to the personnel themselves or further injury to disaster victims.

In order to prevent further injury, information regarding the disaster situation must be collected accurately and rapidly. One approach to overcome this problem is via robots. Robots are very powerful as they are capable of performing many different tasks and operations precisely and do not require common safety and comfort elements that human needs. Robots can access, traverse, maintain, and explore the environments which are hazardous and unreachable by humans also can approach a stricken area very quickly and perform initial information gathering as well as rescue operations.

This research relates to following research fields. In the research field of robot for disaster monitoring and supporting, many of researchers focused on a mechanism to overcome uneven grounds. Hirose et al. proposed snake type's mobile robot[1] and Gunryu (several mobile robots with arm overcome rocks by cooperation among them) [2] for search and rescue tasks. Murphy proposed a parent-and-child robot [3]. The parent mobile robot can navigate on uneven ground, and the child robot (that is getting ready in the parent's inside) can explore some places like cliffs using its rope connecting to the parent robot. Nguyen proposed a robot can discover of the sufferers [4-5]. Where the robot has many sensors, go into a collapsed house and perform searching for victims. However, the reported research above about robot which operated in Japan, USA and European countries. In ASEAN countries, we need to develop similar robot which can operate in the different climate setting and environmental conditions such as typical tropical climate with high humidity and heavy rainfall.

In this paper we report the first stage of developing a mobile robot for disaster monitoring and supporting that has capability to travel over rough irregular terrain within the disaster area and also has